

Diaphragm and rip cage movements during phonation of professional singers of different genres – a dynamic MRI study

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Introduction

Differences in the respiratory strategy during singing phonation in different musical styles (classic, musical theatre, contemporary commercial music) are postulated in voice pedagogy. Additionally also adaptations of the respiratory system for a specific desired voice quality (e.g. Estill Voice Training® differs 6 voice qualities (speech, falsetto, sob, twang, opera and belting) is suggested [1]. Still scientific examinations in this field are rare and due to technical limitations restricted to indirect or external measures of the breathing system. Latest advances in dynamic Magnetic Resonance Imaging (MRI) enable the evaluation of respiratory movements of diaphragm (DPH) and rip cage (RC) during phonation. First studies using this technique emphasize differences in the movement of the respiratory apparatus between exhaling and phonation [2], as well as task and sex related differences in phonatory breathing movements of professionally trained classical singers [3]. It is also of interest to understand whether and how the movement of the RC and DPH during sustained phonation differs according to the genre of the singer respectively the different voice qualities differentiated by Estill Voice Training®.

Methods

For this purpose 8 professional female singers were included in this pilot study (5 western style classically trained singers and 3 contemporary music singers, trained according to Estill Voice Training®). They were evaluated using a 1.5 and 3 T MRI systems concerning their inner respiratory movements during sustained phonation according to [1]. Classically trained singers were asked to phonate in their stage voice. The Estill trained singers were asked to phonate in 6 different voice qualities according to Estill voice Training® (speech, falsetto, sob, twang, opera

and belting). Measurements were acquired in supine position. In a dynamic series of cross-sectional images of the thorax in sagittal orientation characteristic anatomical landmarks were measured. Simultaneous Electroglottography was applied.

Results

Preliminary results show intra-individual differences of the respiratory movements between sustained phonation of different voice qualities, performed by contemporary music singers, trained according to Estill Voice Training®: Here especially belting differed predominant from the other qualities showing a more pronounced rip-cage movement that started at lower lung volumes compared to all other voice qualities. Group differences concerning the respiratory movement of diaphragm and rip cage during sustained phonation for all other voice qualities were minor between contemporary and classically trained singers.

Discussion

A greater understanding of the inner movements of the respiratory system in different genres and for different voice qualities could help to prevent dysbalances in voice production which could lead to vocal overuse. Here greater groups of subjects are desirable for future investigations.

References

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